

WHAT IS CLAIMED IS:

5 1. A material in the form of particles having an average diameter of up to about 350 nanometers, the particles comprising a base particle having an average diameter of up to about 300 nanometers and one or more coating layers on the surface of said base particle, wherein said base particle or at least one coating layer is silica (SiO_2), and said base particle or at least one coating layer is a metal oxide having a refractive index greater than 1.60, wherein the particles have a predetermined refractive index greater than that of silica alone.

10 2. The material of claim 1, wherein the particles have an average diameter of from 10 to 150 nanometers.

15 3. The material of claim 2, wherein the base particle is silica, and the particles contain at least one ZrO_2 or TiO_2 layer deposited by an atomic layer deposition process.

20 4. The material of claim 3 having a refractive index of 1.48 to 1.60.

5. The material of claim 4, wherein the particles have at least one ZrO_2 layer deposited by an atomic layer deposition process upon the silica base particle.

25 6. The material of claim 5, wherein at least one SiO_2 layer deposited by an atomic layer deposition process is present upon the surface of a ZrO_2 layer.

7. The material of claim 4, wherein the particles have at least one TiO_2 layer deposited by an atomic layer deposition process upon the silica base particle.

30 8. The material of claim 7, wherein at least one SiO_2 layer deposited by an atomic layer deposition process is present upon the surface of the TiO_2 layer.

9. The material of claim 7, wherein at least one ZrO₂ layer deposited by an atomic layer deposition process is present upon the surface of a TiO₂ layer.

10. The material of claim 9 wherein at least one SiO₂ layer deposited by an atomic
5 layer deposition process is present upon the surface of the ZrO₂ layer.

11. A curable dental composite material comprising a photocurable polymeric resin and a particulate filler material, wherein the particulate filler material is a material of claim 1 having a refractive index in the range of about 1.48 to about 1.60.

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12. The curable dental composite material of claim 11, wherein the base particle is silica, and the particles contain at least one ZrO₂ or TiO₂ layer deposited by an atomic layer deposition process.

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13. The curable dental composite material of claim 12 having a refractive index of from 1.50 to 1.58.

14. The curable dental composite material of claim 13 wherein the refractive index of the particles is within 0.01 unit of the refractive index of the resin.

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15. The curable dental composite material of claim 14, wherein the particles have at least one SiO₂ layer deposited by an atomic layer deposition process upon the surface of a ZrO₂ or TiO₂ layer.

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16. The curable dental composite material of claim 14, wherein the particles have at least one TiO₂ layer deposited by an atomic layer deposition process upon the silica base particle.

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17. The curable dental composite material of claim 16, wherein the particles have at least one ZrO₂ layer deposited by an atomic layer deposition process upon the surface of a TiO₂ layer.

18. The curable dental composite material of claim 14 wherein the resin is a

diglycidylmethacrylate of bisphenol A (BIS-GMA), dodecanediol dimethacrylate, ethyoxylated bisphenol A dimethacrylate, triethyleneglycol dimethacrylate (TEGDMA), urethane dimethacrylate (UDMA), fluorinated monomeric or oligomeric urethane acrylate or a spiroorthocarbonate monomers or oligomers.

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19. A process for making a filler material having a predetermined refractive index, comprising applying, by an atomic layer deposition process, one or more coating layers to a base particle having an average diameter of up to about 300 nanometers to form a coated particle having an average diameter of up to about 350 nanometers, wherein
10 said base particle or at least one coating layer is silica (SiO_2), and said base particle or at least one coating layer is a metal oxide having a refractive index greater than 1.60, wherein the particles have a predetermined refractive index greater than that of silica alone.

15 20. The process of claim 19, wherein the base particle is silica and at least one coating layer is TiO_2 or ZrO_2 .

21. The process of claim 20, wherein the coated particles have a diameter of 30-80 nm.

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22. The process of claim 21, wherein the coated particles have a refractive index of 1.50-1.58.

25 23. The process of claim 22, wherein a TiO_2 layer is deposited on the silica base particle and at least one ZrO_2 layer is deposited on the TiO_2 layer.

24. The process of claim 22, wherein a silica layer is deposited by atomic layer deposition on top of the TiO_2 or ZrO_2 layer.

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